TEMPLE UNIVERSITY
Department of Mathematics

Applied Mathematics and Scientific Computing Seminar

Wednesday, 27 March 2019, 4:00 p.m.
Room 617 Wachman Hall

(refreshments and social at 3:45 p.m)

Modeling Blood Clotting at the Extreme

by Aaron Fogelson
University of Utah

Abstract. Blood circulates under pressure through the vasculature and consequently mechanical damage to a vessel would result in an outpouring of blood into the extravascular space if there were no clotting response to stem this flow. The vasculature is very diverse in terms of vessel sizes, blood flow speeds, and the forces that the moving blood exerts on a nascent clot. The multifaceted human blood clotting system is able to respond effectively under this wide range of conditions. This great versatility also means that clotting-gone-wrong can occur in a wide range of settings and physical conditions, leading to formation of an intravascular clot (thrombus) that blocks flow through a vessel. In this talk, I will give a brief introduction to the blood clotting system and sketch some of the areas of it that we have, are, or would like to model. I will spend the bulk of the talk discussing our multiscale and multiphase PDE models of platelet thrombosis in vessels the size of coronary and cerebral arteries, settings in which thrombosis often leads to heart attack or stroke. A challenge in modeling thrombosis in these large vessels is to develop appropriate continuum, i.e., population-level, descriptions of different groups of platelets and their biophysical interactions with the fluid, vessel wall, and one another. How can a collection of cells moving rapidly with the blood attach to the vessel wall and to one another and form an occlusive mass that can resist the forces that the flowing blood exerts on them? Under the extreme conditions of a stenotic (constricted) artery, the forces are very large and the time interval in which each platelet must respond is very short. Using an extension of our model, we are poised to address a hypothesized mechanism underlying thrombosis under these extreme conditions.